Richard E. Ericson* and Lester A. Zeager

Ukraine Crisis 2014: A Study of Russian-Western Strategic Interaction

Abstract: This paper presents an analysis of the Ukrainian crisis of 2014 through the lens of the Theory of Moves as formalized by [Willson, S.J., (1998), Long-term Behavior in the Theory of Moves, Theory and Decision, vol. 45, no. 3, pp. 201–240]. It derives the equilibrium (ultimate outcome) states under various assumptions about Western and Russian preferences over outcomes. The “paths” of their generation, i.e., the sequences of strategic choices made by each side, are also explored, casting light on the structure of incentives guiding behavior in the conflict, and perhaps predicting what the actual outcome will be when the world moves beyond this crisis. Incomplete information on preferences prevents derivation of a unique prediction of the outcome of the crisis, but the analysis enables us to substantially narrow the range of possibilities.

Keywords: strategic interaction, conflict modeling, equilibrium outcomes, theory of moves, Ukraine crisis

DOI 10.1515/peps-2015-0006

Previously published online March 27, 2015

1 Introduction

In this paper we present a model of the interaction between the “West” (EU, US, etc.) and the Russian Federation in the aftermath of the seizure of Crimea by a Russian covert, and then open, military operation in February–March 2014. This interaction involves tacit negotiation between leaders in the West and Russian President Putin as various policies, and policy changes, are implemented. As it is an on-going crisis, there is no scholarly literature on which to base the analysis, but only detailed press reports, blogs, tweets from the region, and one author’s

*Corresponding author: Richard E. Ericson, Department of Economics, East Carolina University, Brewster A-428, Mail Stop 580, Greenville, NC 27858, USA,
E-mail: ericsonr@ecu.edu

Lester A. Zeager: Department of Economics, East Carolina University, Brewster A-434, Mail Stop 580, Greenville, NC 27858, USA

observations during visits to Russia (April 2014) and Ukraine (December 2013, June 2014, and October 2014).¹ Thus the analysis is exploratory.

The revised version of the theory of moves (ToM) formulated by Willson (1998) offers a convenient framework for analyzing the strategic interaction between the main actors in this crisis. It uses the policy alternatives for those actors to form a matrix of “states” (i.e., possible situations on the ground, each associated with a pair of policies, one for each actor) over which each actor has a preference ordering. We identify an “initial state” from the history of the crisis, and the strategic interaction begins when one actor changes its policy unilaterally, thus moving play into a new state. The “negotiations” (implicit in this case) continue with the actors having alternating turns to move. At each such opportunity, an actor can “move” (change its policy) or “pass” (maintain its policy). The strategic interaction ends after two consecutive passes, which represents an (at least implicit) agreement by the main actors to accept the current state as the “ultimate outcome” (UO) of the interaction, or after reaching a finite limit on the total number of moves. In all of the games we consider, the UO are independent of the total number of moves allowed (above a low threshold). Thus, given the policy alternatives for the actors and their preference orderings over the possible outcomes, we obtain predictions from the model about the UO and the equilibrium path(s) to that outcome, both of which can be compared to the unfolding events in the crisis. Although incomplete knowledge of the preference orderings prevents derivation of a unique prediction of the UO, the analysis enables us to narrow the range of possibilities considerably.

The original and revised versions of ToM differ in their specification of the rules governing the interaction between the players. In the original version by Brams (1994), one “pass” by any player after the initial move terminates play. By requiring two consecutive “passes” to end play, Willson’s (1998) revised version allows a player to reverse moves, e.g., impose and later retract sanctions or invade and later pull out, which more richly models the give-and-take of the strategic interaction in the Ukrainian crisis than do the rules of play in the original version. It allows a player to “test” the resolve of the other player by initiating moves and observing the responses, without trapping oneself

¹ Among the sources are the daily reports in the *New York Times*, the *Wall Street Journal*, and *Vedomosti* (Moscow), and their reporter’s blogs. Of particular value have been the reports of Greg L. White <online.wsj.com/news/author/1570>, the almost daily analyses based on regional press reports in the *Eurasia Daily Monitor* <www.jamestown.org/programs/edm/>, and the WSJ’s “Crisis in Ukraine” stream <stream.wsj.com/story/...>.

in an undesirable situation. In addition, unlike the original version of ToM (Brams 1994), the Willson (1998) formulation can accommodate more than two policy alternatives for each actor, and they need not necessarily have the same number of alternatives. As in all modeling exercises, we want to adopt rules of play that fit the possibilities in the situation. Zeager, Ericson, and Williams (2013, chapter 4) compares the two versions of ToM more thoroughly. Kilgour (1984), Kilgour and Zagare (1987), Simon (1996), and Brams (1997) offer examples of related work within the ToM framework. Gilboa (1995) provides a thoughtful review of the ToM “project” from the perspective of a prominent game theorist.

As the analysis will show, the UO of the strategic interaction between the West and Russia in the revised version of ToM is very robust to changes in the preference orderings of the two sides over the possible outcomes. For five of the eight plausible scenarios that we consider (each associated with a different configuration of preference orderings) – and many more variations on these specifications – the UO involves Western economic sanctions together with active destabilization of the Ukrainian state by Russia. In two other scenarios, the UO has a business-as-usual policy (neither economic sanctions nor military assistance) by the West, despite active destabilization by Russia. In the remaining scenario, the UO involves Western economic sanctions in the face of an invasion of Ukraine by Russia. Thus, the most common UO emerges for a wide range of scenarios, and in the other plausible scenarios, only one of the parties ultimately settles on a different policy.

We organize the paper as follows. Section 2 specifies in very broad terms the policy alternatives for the actors, the possible outcomes (situations on the ground) resulting from each pair of policies, and preferences for each actor over those outcomes. Section 3 identifies the initial state for the analysis, the move that begins the strategic interaction, plausible rankings of the possible outcomes for each side (with several variations), the UO for various combinations of preferences, and investigates (for the most interesting scenarios) the incentives and constraints guiding the actors along the equilibrium paths to those outcomes. Section 4 concludes. There we consider, in part, how the Ukrainian leaders would rank the possible outcomes of the interaction, the UOs that emerge from our analysis, and how their actions could influence the details of the preference orderings of the main actors, and thus, perhaps, the ultimate resolution of the crisis. Appendices contain: (5.1) a more elaborate description of the states arising from each policy combination; (5.2) a time line of key events and dates of the crisis during the year from 22 February 2014 to 15 February 2015; (5.3) summary tables of all the preference rankings we analyze; (5.4) a description of the Gauss program used to calculate the UO.

2 Western and Russian policy preferences

2.1 Policy alternatives

To keep the analysis tractable, the policy alternatives are described in very broad terms, hoping to only capture the essentials of what matters to the parties involved. Hence we consider only three policy alternatives for each side. Even this small set of policies strains the information we have on the preferences and motivations of the major actors; more policy choices would go well beyond what we can claim to know.

A consistently pursued “policy pair” (one by each side) frames the situation on the ground, substantially impacting, if not fully determining, outcomes for the Ukrainian people and the economies of both Russia and the West. It is over these potential outcomes, resulting from their policy choices, that each side has preferences which, given the constraints embedded in the structure of the model, will drive the policy choices of each side. The UO, the ToM equilibrium of this strategic interaction, provides a prediction of the likely result of this crisis given the preference ordering driving decisions on each side.

- General Policies of Model Agents:
 - Russia:
 - **LG** – “let go,” i.e., cease all active interference in Ukraine;
 - **DS** – “destabilize,” i.e., actively support (with covert forces, “volunteers,” and military equipment), the opposition/insurgents, use economic leverage/sanctions to undercut government;
 - **IN** – “invade” openly, perhaps under the guise of “peacekeepers” protecting the lives of Russian minority.²
 - West:
 - **BU** – “business as usual,” i.e., turn a blind eye toward Russian actions, attempting to maintain normal commercial relations, and political cooperation in other areas (e.g., non-proliferation, Iran, etc.), with Russia;
 - **SN** – economic “sanctions” as incentive to modify Russian behavior;
 - **MA** – “military aid” to Ukraine,³ in addition to maintaining sanctions.

² We understand “invasion” to be a reversible military incursion, possible because of near total Russian military superiority over Ukraine. Its purpose in this interaction would not be to destroy or seize Ukraine, although it could ultimately lead to the separation of the *Novorossiia* part (Donetsk, Luhansk, and perhaps more of the coast).

³ As this military assistance is taken to stop short of direct western military participation in combat, “boots on the ground,” it can only raise the costs to Russia of **IN** without having a meaningful impact on the military situation on the ground.

Of course, there are many gradations and variations of these policies that might be considered, but we begin with these broad strategic thrusts as commensurate with the data available.

2.2 Preferences of the actors

The agents preferences are modeled as being generally formed by the costs and benefits in two different dimensions: geopolitical and economic. History, culture, and ideology of course play a deep role in informing and molding the perception of costs and benefits in each of these dimensions.⁴

For Russia, the policies are listed above in order of increasing economic costs for a given strategy (policy stance) of the West, although changing Western policies can alter that ordering. They are also (weakly) ordered, for a fixed Western policy, in terms of increasing geopolitical benefits, although again that can be altered by changing Western strategies. These conditional orderings along a single dimension cannot uniquely determine the ordering over the “states” (situations) arising from the nine policy combinations of the two primary agents; agents’ preferences over trade-offs across dimensions must be considered to complete that ordering. Russia’s underlying policy motive, moreover, appears to be geopolitical, subject perhaps to economic constraints. In particular, Russia feels threatened by a Western-oriented, democratic Ukraine, extending the EU, and perhaps NATO, to its “soft underbelly.” That overriding fear drove the rapid military seizure and subsequent annexation into the Russian Federation of Crimea and Sevastopol, a prior move (to this analysis) that set up the current crisis. Russia is a “revisionist power” seeking to alter current international institutional arrangements, norms, and configuration of power/influence. These motivations inform trade-offs, feeding into Russia’s evaluation of, its preference ordering over, the outcomes generated by her policy choices together with those of the West. Still, it is not completely clear how these policy motivations, and the policies pursued, interact with the policy choices of the West in determining Russia’s full preference ordering over outcomes “on the ground,” an issue we explore in the analysis.

The West comprises the “established powers” that manage, and generally benefit from, the existing world order, the maintenance of which constitutes a

⁴ Among the works exploring how such factors influence the beliefs, understandings, and choices of Russian (and for a period, Soviet) decision makers are Hedlund (2005), Keenan (1986), and Pipes (1974).

primary, underlying motivation for Western strategic choices. Western policies are also weakly ordered in terms of increasing economic cost, with “military assistance” adding to the cost of sanctions even if it does not go as far as active Western combat participation. But their geopolitical implications for the West are very different, involving increasing benefits in terms of credibility and the maintenance of modern norms of international behavior. To explain how these norms relate to the Ukraine crisis, we recall an observation by Coplin (1965) that the modern international system rests on three assumptions that have prevailed since the Peace of Westfalia in 1648: (1) the ultimate imperative for each state is its security, (2) international politics is a struggle for power with each state aiming to gain power, and (3) a balance of power must be maintained among the states. Coplin (1965, 630) recognized that international norms have evolved since 1914: “The freedom to use military power, once an essential characteristic of sovereignty and an integral part of international law, is no longer an accepted international legal norm.” In the Ukraine crisis, Russia issued a challenge to this new thinking. How would the West respond? As was the case with Russia above, the conditional orderings for the West along each single dimension must be extended to a complete ordering over the nine “states” resulting from the strategy pairs. Moreover, it is not completely clear how these general policy motivations interact with the policy choices of Russia that determine outcomes “on the ground,” providing a preference ordering over those outcomes.

These considerations, and the indeterminacy they allow in agent orderings of outcomes, lead us to work with a number of plausible orderings to see what outcomes might result from the negotiation-like sequential strategic interaction modeled in ToM. This will allow us to explore the possible equilibria (UO) of this strategic interaction, and highlight critical factors in their generation. It is an extrapolative analysis, rather than explanatory analysis as in Zeager et al. (2013), yet it can narrow the range of possibilities for the predicted outcome in this ongoing crisis.

2.3 Potential outcomes of West-Russia policy combinations

Each West-Russia policy combination, for example, **BU-LG**, if consistently maintained as an (if only tacitly) agreed outcome can be associated with a set of physical conditions, of sociopolitical, economic, and military characteristics resulting from these maintained policies. In Appendix 5.1, we elaborate the consequences in each of the nine potential outcome states, and indicate what we believe to be the most plausible attitudes, based on those consequences, of both Russia and the West toward that situation as a final outcome. All the nine possible situations

arising from policy combinations of the major actors, their perception and valuation by the relevant agents, must be compared by those actors to generate their (ordinal) preference rankings required by the analysis. Potential rankings from highest, “9,” to lowest, “1,” are presented in number pairs, (**n, m**), where **n** is the ranking of the West and **m** is the Russian ranking.⁵

Constructing these ordinal rankings of the nine potential “states of the world” arising from the complex interactions of these policy combinations is a crucial first step in our analysis. It requires careful consideration of all the ramifications of each actor’s policy as it unfolds in the face of the policy being pursued by the other actor, and prediction of the most likely consequences of this interaction. We present the results of this analysis in Appendix 5.1, and here only list the nine outcome states and the ordinal preference rankings associated with them by each actor, based on the reasoning presented in that Appendix.

- **BU-LG** The West pursues “business as usual” and Russia steps back from direct interference in Ukrainian affairs (“letting go”), albeit retaining Crimea. (**9, 3 or 4**)
- **BU-DS** The West pursues “business as usual,” while Russia pursues active destabilization of the Ukrainian polity and economy. (**5, 8 or 9**)
- **BU-IN** The West’s “business as usual” strategy is maintained in the face of an open Russian cross-border military incursion into Ukraine. (**3, 8 or 9**)
- **SN-LG** The West imposes costly (to itself as well as Russia) sanctions for seizing Crimea, while Russia has “let go” of independent Ukraine, if not Crimea. (**2, 1 or 2**)
- **SN-DS** In this state the West is responding with consistent, serious economic sanctions to the systematic military, political, and economic destabilization of Ukraine by Russia and its proxies in Ukraine. (**7 or 8, 6 or 7**)
- **SN-IN** In this state Russia has launched and maintains an active military intervention in eastern Ukraine, to which the West’s response is perhaps some strengthening of economic sanctions, answered in kind by Russia. (**6–8, 6 or 7**)
- **MA-LG** The West provides substantial military assistance to Ukraine, while continuing to sanction Russia, after Russia has “let go” of further attempts to control Ukraine’s destiny, beyond seizing Crimea. (**1, 1–3**)
- **MA-DS** The West provides substantial military assistance to Ukraine, while continuing to sanction Russia, as Russia continues to actively destabilize Ukraine. (**4, 2 or 5**)

⁵ The orderings presented after each “state” reflect our (incomplete) understanding of the actual situation. We however also analyze outcomes for different, more likely counterfactual, preferences in order to explore the robustness of our results, and to illustrate how different preferences can alter the equilibrium outcome of this interaction.

- **MA-IN** This is a “brink of war” state of the conflict. Russia has launched a cross border invasion of Ukraine, albeit with limited objectives, while the West has added direct military support, short of combat forces (“boots on the ground”), to Ukraine while continuing to impose significant economic sanctions on Russia. **(7, 4 or 5)**

While the ranking for some of these terminal states is clear, for others it is not. Thus we will analyze a number of different ToM-matrices, each reflecting a different (in part) preference ordering of one or both of the decisive parties. This will allow us to explore more fully how outcomes might depend on (unknown) preferences, the potential paths that the “negotiations” might follow, and the ability of ToM analysis to aid understanding of, and make predictions about, the final outcome that is yet to be determined.

3 The basic model

Modeling a strategic interaction as a ToM game requires not only specifying the “players,” their strategies, and their preferences, but also an initial “state” together with a “first mover.”⁶ In any ToM formalization, the initial state and first mover are given by the history of the crisis. Subsequently, players alternate their moves, with a player at her turn choosing either to maintain her current policy stance (a “pass”) or to alter those policies (“move”), selecting a different policy stance. Play ends after 2 consecutive passes, representing an (at least tacit) agreement to accept the current state (at which each “passed”) as final, i.e., the UO, or after the players have collectively exhausted a fixed, finite number of moves. The finite termination ensures existence of a UO, although that may cycle, depending on the first mover and the fixed number of moves in the game, as discussed in Willson (1998). In the payoff configurations that we consider, ToM always gives a single UO, independent of initial state and first mover, in fewer than six moves. This is a consequence of the specific set of preferences that we find plausible. Willson (1998, 216) proves the existence of a very loose, finite bound on the number of moves for convergence to either a fixed UO or alternating UO, depending on first mover and parity of the number of moves. Note that our 6-move horizon is similar to the horizon that Kilgour and Zagare (1987) find necessary to solve sequential-move games with 2×2 payoff configurations

⁶ Zeager, Ericson, and Williams (2013, chapter 4) discusses such modeling in depth.

using the original ToM framework. Their result, however, applies to *all* such 2×2 ordinal games.

The choice of an initial state for the analysis is somewhat arbitrary, but some points allow us to formulate more interesting questions than others do. For example, we might take the initial state to be **BU-IN** (West pursuing “business as usual” while Russia seizes Crimea militarily), and the first move to be the Western response thereto, selected from **{BU, SN, MA}**. In fact, sanctions were slowly imposed (**SN** pursued), leaving Russia to either move militarily into eastern Ukraine (maintain **IN**), ratchet back its intervention to **DS** (destabilizing through stimulation of rebellion, provision of “volunteers”/mercenaries, and supply of weapons and equipment to the armed revolt in the east), or switch to **LG** (let go, abandoning for a time, further ambitions to control Ukraine and block Western influence). However, the seizure of Crimea, since 18 March 2014 formally incorporated into the Russian Federation as a constituent member, albeit unrecognized by the West, must now be considered as irreversible in the context of the current crisis; short of a Russian military defeat in a hot war with the West, it is irreversible. Thus Russia would never move from **IN** despite any Western actions/strategies within the scope of those we are considering.

Hence, for this analysis we will take the initial state to be **BU-DS** (March–April 2014) with the West engaged in “business as usual” in disbelief of what is happening, while Russia actively engages in destabilization of Ukraine through fostering, sponsoring, and arming unrest in the Ukrainian east among the Russian ethnic population and those who lost influence (and rents) with the fall of the Yanukovich regime. This **DS** strategy involves the insertion of leadership, weapons, finance, and mercenaries on the side of those opposed to the new “Maidan” government, raising the hope, indeed expectation, among those most dissatisfied in the region, that Russia would again “do a Crimea” and annex them into the Russian Federation, where they would be protected from both Ukraine and the West. It is worth noting that, in this state, Russia is also maintaining an active readiness posture (including large-scale military exercises during summer and fall of 2014) for quick invasion should that be decided on. The first move is then the West’s, to either “pass” (continue **BU**), or respond with sanctions (**SN**), or move to providing military support to Ukraine as well as imposing sanctions (**MA**). In fact, the West chose **SN** (slowly introduced from late March 2014), as the model predicts from the preferences outlined above.⁷ This leaves the interaction in the state **SN-DS**. Could this be a long run (ultimate) outcome of the

⁷ While we take the first move as given in the game-tree analysis (Section 3.2), recursive rationality can be used to evaluate whether such a move is optimal, as indeed it is in this case.

interaction? And what might that mean for the situation “on the ground,” for the fate of Ukraine and its people? A major purpose of this analysis is to explore those questions under the ToM assumptions of agent farsightedness and rationality. To provide context, we include a time-line of key events in Appendix 5.2.

3.1 ToM payoff matrices and scenarios

All the matrices summarizing scenarios that we consider are collected in Appendix Figures 1 and 2 in Appendix 5.3. We begin the analysis with what we consider one of the most plausible rankings of the outcomes described above from the perspective of each side, presented in the ordinal “payoff” matrix labelled “Scenario 1” below. Note that these rankings do not reflect the preferences of the Ukrainian state or people; those only have an impact to the extent they are considered by the major actors, Russia and the West.⁸ But the rankings are predicated on the assumption that Ukraine, or whatever part of it remains out of Russian control, continues to pursue a Western orientation, and that the West does not totally abandon independent Ukraine. The West’s preference ordering reflects an aversion to the application of sanctions, except as a response to active Russian destabilization or invasion of Ukraine, and an even stronger aversion to providing military assistance, unless Russia invades. For the West, the best of all possible outcomes is **BU-LG**. Russia’s preferences reflect a total unwillingness to “let go” of Ukraine, as well as an unwillingness to accept active Western intervention, particularly in the form of military assistance to Ukraine. The latter (**MA**) makes invasion the most desirable strategy for Russia, although Russia would otherwise prefer to “neutralize” Ukraine through destabilization. For Russia, the best possible outcome is **BU-DS**, where the West ignores Russia’s disruption of the Ukrainian state.

Scenario 1: Western-oriented Ukraine unacceptable to Russia.

		Russia		
		LG	DS*	IN
West°	BU	(9, 4)	(5, 9)°	(3, 8)
	SN*	(2, 1)	(8, 7)*†	(6, 6)
	MA	(1, 3)	(4, 2)	(7, 5)†

⁸ We consider Ukrainian leaders’ preferences in the Conclusion, and the possibility that the impact of their actions might influence the preference orderings of Russia and the West.

The structure of preferences in Scenario 1 gives a very strong and clear prediction: recursively rational actors in this sequential-move ToM game will converge, from any initial state, regardless of who makes the first move, to the “UO” **SN-DS** – Western economic sanctions in the face of active destabilization of the Ukrainian state by Russia.⁹ These “equilibrium” strategies are indicated by an asterisk. With our initial state (**BU-DS** – superscript °) and first mover (West), this outcome can be achieved immediately, or reached after chains of threat and counterthreat – chains of policy changes threatened or temporarily implemented. The UO is achieved within four moves, independent of initial state and first mover. From our initial state it takes only 1 move, followed by two optimal passes, although there are numerous 4-move paths that reach the same ultimate outcome. We explore some of these paths to the UO in the ToM game tree in Section 3.2. It is, however, worth noting that this is one of two pure-strategy Nash equilibria (**MA-IN**, **SN-DS** – superscript †) in the standard, normal-form simultaneous-move game, and is the Pareto dominant Nash equilibrium (NE).¹⁰ Note that this UO avoids the suboptimal (for both) “coordination trap” at **MA-IN**.

This scenario admits a number of plausible variations in the orderings. The top of the Russian preference ordering seems clear, although the top two states might be reversed, and the ordering among the next three states could be altered, particularly as we assume that the West is unwilling to use (or, perhaps, is incapable of using) its own military forces in defense of Ukraine. Note that here we assume that Russia would prefer to “let go” of Ukraine if the West pursues “business as usual” rather than destabilize Ukraine in the face of Western military assistance, a perhaps questionable assumption. On the other hand, Russia might have a preference for invasion over destabilization, conditional on a given West strategy, even though those strategies are well ordered in Russian preferences (**BU** > **SN** > **MA**). The West preference ordering over Russia strategies is more complicated, involving trade-offs (economic vs. geopolitical) across Russian strategies. Still the top three states, involving “proportionate” response to Russian actions, seem relatively uncontroversial. However, we explore variations in both preference orderings to explore the robustness of this equilibrium and to understand the impact of differences in preferences on the UO of this interaction.

⁹ This “UO” is solved in a Gauss program, which is available on request. The program implements a dynamic programming backward recursion in moves remaining; see the discussion in Appendix 5.4.

¹⁰ There is a third, mixed strategy NE, $\{(0, 0.75, 0.25), (0, 0.2, 0.8)\}$, which is, however, not invariant to ordinal transformation of the payoffs.

3.1.1 Variations in Russian preferences

There are several plausible permutations of the Russian ordering of the lowest four states, but these do not affect the UO, as can be seen in one of them (Scenario 2). Again, independent of initial state and first mover, the UO is **SN-DS**. The same two pure strategy Nash equilibria also remain, despite **LG** being a dominated strategy for Russia.¹¹ The West's willingness to escalate (dominant diagonal) along with Russia, and respond strongly to an invasion by Russia, is critical in generating this more desirable (for the major powers, not Ukraine) equilibrium of the strategic interaction.

Scenario 2: Letting go always worse for Russia.

		Russia		
		LG	DS*	IN
West°	BU	(9, 3)	(5, 9) [°]	(3, 8)
	SN*	(2, 2)	(8, 7)* [†]	(6, 6)
	MA	(1, 1)	(4, 4)	(7, 5) [†]

Indeed, as long as Russia will not seriously contemplate “letting go” of Ukraine (abandoning a critical geopolitical interest), only the rankings among the states arising from “destabilization” and “invasion,” and their interaction with the West's policies, can have an impact on the outcome. One Russian preference change that might have a big impact is a reversal of the ordering of **SN-DS** and **SN-IN** (ordinally valued at 7 and 6) in the face of Western sanctions (Scenario 3). This eliminates all but one NE in the simultaneous-move game, but leaves the sequential-move Ultimate Outcome unchanged. Indeed, the UO is no longer a NE, and the NE is strictly inferior for both sides.

If Russia uniformly prefers “destabilization” to “invasion,” reversing the valuations of the states valued 4 and 5 in Scenario 2, the only impact is to eliminate the **MA-IN** state as a pure-strategy NE; the **SN-DS** Ultimate Outcome of the ToM analysis is unaffected. This illustrates both the robustness of the UO and a significant difference between the simultaneous- and sequential-move analysis of the strategic interaction in this case.

It is also worth noting that further reversing the top two states in the Russian ordering (Scenario 10 in Appendix Figure 2, Appendix 5.3), does not affect either type of outcome, despite **IN** becoming a dominant strategy, in the Nash sense,

¹¹ The mixed-strategy equilibrium naturally changes, but still involves randomizing among the two pure equilibrium strategies: $\{(0, 0.5, 0.5), (0, 0.167, 0.833)\}$. Here we can see the extra weight Russia's preferences put on intervention in the West's increased emphasis on the **MA** response.

for Russia; **SN-DS** remains the UO and **MA-IN** the sole NE. Finally, if the Russian preferences for **DS** and **IN** were reversed in the Scenario 2 matrix (Scenario 9 in Appendix Figure 2, Appendix 5.3), the UO, **SN-DS**, remains unaffected, but all pure strategy Nash equilibria disappear, leaving only a mixed-strategy NE:

$\left\{\left(\frac{1}{2}, 0, \frac{1}{2}\right), \left(0, \frac{2}{7}, \frac{5}{7}\right)\right\}$, with the West mixing 50–50 between ignoring Russia's

behavior (**BU**) and providing military assistance (**MA**), and Russia at least destabilizing (**DS**), but most likely invading (**IN**). This kind of outcome leads us to reject the NE of a simultaneous play game as a useful analytic framework for these international interactions.

Scenario 3: Russia escalates against sanctions.

		Russia		
		LG	DS*	IN
West ^o	BU	(9, 3)	(5, 9) ^o	(3, 8)
	SN*	(2, 2)	(8, 6)*	(6, 7)
	MA	(1, 1)	(4, 4)	(7, 5) ⁱ

Thus we have a unique, from any initial state and any initial mover, equilibrium (UO), involving ongoing active Russian destabilization of the Ukrainian polity answered by strong Western sanctions. It can again be rapidly attained (1 move) from our initial situation, and within four moves for any initial state and mover combination. As we will see, only different West preferences, more averse both to sanctions and to providing military aid to Ukraine, can upset this stable outcome.

There are other Russian preference orderings, valuing economic ties with the West above the geopolitical situation on its southwestern boundary, but we do not consider these plausible, at least under the current Russian political leadership. There is perhaps greater room for variation in West preferences, particularly as they are the result of negotiation and compromise among many sovereign states with numerous divergent interests.

3.1.2 Variations in Western preferences

We have so far worked only with what we believe are the most plausible West preferences, but the strategic interaction becomes more interesting when we alter them. In doing so, we have greater leeway, as the West is hardly a homogeneous decision maker, but must rather negotiate policies/strategies among nations

with very disparate interests. Even the EU, without considering the US position, is not the coherent decision maker that Putin’s Russia is. Thus we explore several variations in the finer structure of West preferences to see how robust the **SN-DS** outcome actually is to changes in that structure.

In the basic model we have taken West preferences to have a “dominant diagonal” structure: the West responds to escalation by Russia with an escalation in its policies, albeit always preferring the weaker response when it is appropriate. The worst situation for the West, in any conceivable preference ordering, is to engage in hostile action when Russia “lets go,” in which case “business as usual” is a natural best state. But as soon as Russia engages in “destabilization” or “invasion,” one might imagine both stronger and weaker responses than those assumed above.

The strongest conceivable response (e.g., Aron 2014), given that direct military intervention on the ground is inconceivable, would hold business as usual in response to invasion or destabilization as the third and fourth worst states respectively, with **MA-DS** the fourth and **SN-IN** the fifth best responses. If we take the base case Russian preferences as in Scenarios 1 or 2, this West ranking gives the following (Scenario 4) structure of interaction:

Scenario 4: Strongest West response.

		Russia		
		LG	DS*	IN
West°	BU	(9, 4)	(4, 9)°	(3, 8)
	SN*	(2, 1)	(8, 7)*†	(5, 6)
	MA	(1, 3)	(6, 2)	(7, 5)†

This strengthening again results in the unique, stable UO, **SN-DS**, to which the interaction converges, within four moves, from any initial state with any first mover. Indeed, from the actual initial state (**BU-DS**) and mover (*West*), it can be achieved in the first move. And again there are the same two pure-strategy Nash equilibria, and a mixed-strategy equilibrium $\left\{\left(0, \frac{3}{4}, \frac{1}{4}\right), \left(0, \frac{1}{2}, \frac{1}{2}\right)\right\}$, of the simultaneous move game, the Pareto optimal one of which is the UO.¹²

There are many variations in West preferences that favor weaker responses to Russian destabilization and/or invasion of Ukraine. One such situation, in

¹² This equilibrium (UO) is robust against any permutations in Russian preferences over the four worst states for Russia, against reversal in her ordering of the top two states, or of the next two (states 6 and 7). The last change, however, eliminates the UO as a NE.

which domestic political considerations rule out any form of military assistance, is given in Scenario 5. Again the UO is **SN-DS**, as the West still shows a taste for sanctions in response to aggressive Russian policies. And again it can be achieved in a first move from the initial state by the West, or by no more than four moves from any initial position and first mover. This UO is also the sole NE. Again this UO is robust to the kinds of permutations of Russian preferences discussed above, although reversing 6 and 7 in the Russian ordering moves the NE to **SN-IN**; with single simultaneous moves, Russia would choose to invade.

Scenario 5: Military assistance “Unthinkable” for the West.

		Russia		
		LG	DS*	IN
West°	BU	(9, 4)	(6, 9)°	(5, 8)
	SN*	(2, 1)	(8, 7)*†	(7, 6)
	MA	(1, 3)	(3, 2)	(4, 5)

A further weakening in the West’s willingness to respond could favor “business as usual” (**BU**) in the face of destabilization (**DS**), only supporting “sanctions” in the case of a Russian invasion of eastern Ukraine. This shifts the UO to **BU-DS**, and makes it the only pure strategy NE as well (Scenario 6). Thus Russia engages in intensive destabilization, while the West pretends it is not happening. Were Russian preferences to reverse the 6 and 7 ordering as above, then another pure-strategy NE, **SN-IN**, appears; in a simultaneous-move interaction, the West could be caught using sanctions against an invasion despite its reluctance to do so.¹³

Scenario 6: MA & sanctions “Unthinkable,” unless invasion.

		Russia		
		LG	DS*	IN
West°	BU*	(9, 4)	(8, 9)°*†	(6, 8)
	SN	(2, 1)	(5, 7)	(7, 6)
	MA	(1, 3)	(3, 2)	(4, 5)

13 There is also an mixed-strategy equilibrium, $\{(0.5, 0.5, 0), (0, 0.25, 0.75)\}$, with Russia three times as likely to invade as to destabilize, which is again not invariant to order preserving transformations of the “payoffs” (preference rankings).

If the West retains an aversion to action except in the case of that most egregious violation of international norms, an Invasion (Scenario 7), we get the same UO, **BU-DS**, where it pretends not to notice Russian aggression, short of invasion, against Ukraine. But a strong West willingness to provide military assistance in case of an invasion generates a new, Pareto-inferior, NE, **MA-IN**, in the simultaneous-move interaction – the strongest available Western response to the strongest Russian action. In a sequential-move framework, with its proffered opportunities and implicit threats, this negative outcome is avoided.

Scenario 7: Strong West response only to invasion.

		Russia		
		LG	DS*	IN
West ^o	BU*	(9, 3)	(8, 9) ^{o*†}	(5, 8)
	SN	(2, 2)	(4, 6)	(6, 7)
	MA	(1, 1)	(3, 4)	(7, 5) [†]

Finally, consider the situation where the West is reluctant to provide military assistance, preferring Sanctions in the case of Invasion, and Russia decides it needs to insure *Novorossiia* autonomy in, or independence from, Ukraine (Scenario 8), perhaps as a first step toward annexation, as it was with Crimea in February 2014. **IN** is then a dominant strategy for Russia and **SN** remains the West's best response.¹⁴ Here the UO, **SN-IN**, is achieved after three or more moves; it is also the only (pure-strategy) NE in the simultaneous move interaction. Thus Russian military intervention is met by hand-wringing and continuing, perhaps strengthened, economic sanctions which Russia ignores in its single-minded pursuit of its primary strategic objective.

Scenario 8: Russia "Must Control Ukraine."

		Russia		
		LG	DS	IN*
West ^o	BU	(9, 3)	(5, 8) ^o	(3, 9)
	SN*	(2, 1)	(8, 6)	(7, 7) ^{*†}
	MA	(1, 2)	(4, 4)	(6, 5)

¹⁴ Here we strengthen Western resolve relative to the preferences in Scenarios 5 and 6, reflected in a preference for **MA** over **BU**, unless Russia "lets go."

It is worth noting that this UO, **SN-IN**, is far less robust to variations in preferences than **SN-DS**. It critically depends on the West preferring **SN-IN** over **MA-IN**; one of the few variations in Russian preferences that preserves this UO is given in Scenario 13, Appendix Figure 2, Appendix 5.3. There, even though the top two states in Russia's preferences have their order reversed, so **IN** is no longer a dominant strategy, the UO remains **SN-IN**. If that West preference ordering is reversed, and the West would rather provide military assistance than apply further sanctions, the UO of recursively rational sequential interaction reverts to **SN-DS**, as in almost all the scenarios that we have considered. The NE also shifts, but in the other direction; **MA-IN** becomes the sole NE of the simultaneous-move interaction. Thus behavior built on simultaneous best-response traps both sides in an inferior outcome; the UO Pareto dominates the NE.

There are many other West preference orderings with varying degrees of aversion both to sanctions against Russia and to providing military assistance to Ukraine. All of these orderings have the same qualitative strategic characteristics as those we have analyzed; Scenarios 11 and 12 in Appendix Figure 2 of Appendix 5.3 reflect two such orderings, both of which have with some claim to plausibility. These Western preferences all imply that Russian destabilization of the Ukraine will ultimately be ignored by the West, even if early moves to impose sanctions, or even to provide military assistance to Ukraine, were to be undertaken. The strategic structure of these interactions is such that recursively rational actors with these preferences must eventually settle on the UO, **BU-DS**, which abandons Ukraine to destabilization.

3.2 Analysis of ultimate outcomes

The ultimate outcomes in these scenarios display a number of similar and important features. These features are shaped by the conflicting interests reflected in Russian and Western preferences over the “states of the world,” differences most clearly expressed in the very top and the bottom four states of the preference orderings. For Russia, given its strong geopolitical focus, the only significant impact of a change in preferences is a preference for “Invasion” over “Destabilization” in the face of Western sanctions, which moves the UO to **SN-IN** when the West is sufficiently reticent to turn to “Military Assistance,” but still prefers action to Business as Usual (Scenario 8). For the West, with its focus on commercial relations and strong aversion to military confrontation, the changes in preferences explored here have similarly little impact. Even the ordering most supportive of strong action (Scenario 4) fails to move the UO; only a substantial weakening in resolve can shift it, and then to **BU-DS** –

pursuing “Business as Usual” despite active Russian destabilization of Ukraine (Scenarios 6, 7, 11, and 12). It is also interesting to note that a weakening of Western taste for action can move the NE to states where Russia exploits those preferences (Scenarios 1, 7–11, and 13). Thus the simultaneous-move analysis predicts a far more confrontational outcome/equilibrium, **MA-IN**.

The “farsightedness” of the sequential decisions in ToM leads to compromise that settles on “sufficiently good” outcomes for each side that reflect the relative determination of, and constraints facing, the players. Thus, the UO capture the Pareto optimal (pure strategy) NE when it exists, and, in all our cases, a state on the Pareto frontier even when no NE are on that frontier. Thus the possibility of a coordination trap, such as can easily occur in NE, is avoided, as we will see in the analysis of the ToM game trees below. It also generates the perhaps surprising robustness of the Ultimate Outcome to the finer details of the preference orderings, details that affect NE. The result of this exploration of what we see as the full set of plausible preferences orderings is a strong prediction for the outcome of this crisis: the West will apply economic sanctions, Russia will actively destabilize, or invade openly, and Ukraine will remain a dysfunctional state, paralyzed by the “frozen conflict” in its eastern provinces, the situation Moldova faces with Transdnestria.

A significant benefit of using ToM for analysis of this strategic interaction is that its sequential nature also allows exploration of the paths that the interaction could take as the parties grope/negotiate toward a mutually acceptable state of the world, a stable UO. The interaction can be concisely summarized in a finite game tree where each rational player recursively derives, for any state in which she might find herself, the value of each possible continuation move, assuming the other player is similarly rational. The game tree thus clearly displays not only the UO, but also the path(s) (sequences of alternating decisions) of equilibrium play that achieves that UO. Typically, there will be multiple paths that reach the UO, involving different threats and counterthreats that support the equilibrium. The longer the horizon of the game, the more opportunities there will be to “test” the opponent, to allow her to make a mistake, before being forced to settle into a shortest direct path to the UO.¹⁵

Here we use 4-move game trees to analyze a couple of the scenarios we have presented. We begin with our base case, Scenario 1. Before late August 2014, this appeared to best reflect both Western and Russian preferences. As mid-summer Ukrainian military successes reduced the likelihood of a permanent “frozen conflict” in the Ukrainian east, Russia has appeared to become increasingly unwilling

¹⁵ These types of dynamics are discussed in some detail for the analysis of refugee negotiations in Zeager et al. (2013, chapters 5 and 6).

to accept the defeat of its “insurgents” in the Ukraine. Hence Scenario 8, also analyzed below, may become the most relevant, as long as the West does not give up on Sanctions as a response and return to “Business as Usual,” accepting the partitioning of the Ukrainian state (Scenarios 6, 7, 11 and 12).

3.2.1 Scenario 1 analysis

In four interconnected figures (Figures 1–4), we display the possible paths from the initial state and highlight the equilibrium paths leading to the UO in our primary specification (Scenario 1), capturing what we believe are most likely to be the actual preferences of both sides of this conflictual situation. We start (root node) from the historically given initial state (**BU-DS**) and first mover (West). We limit the analysis to an interaction with four moves, a sufficient number for convergence from any initial conditions (state, mover). This allows several alternate equilibrium paths to appear; more would appear with a longer horizon, but the UO remains the same, **SN-DS**, with the West achieving (given these preferences) its second best state and Russia — its third best, (8,7).

The first move by the West is taken as given. Thereafter, the players have alternating turns to move. The player with a turn to move can either maintain its policy (pass) or change its policy (move). The game ends after two consecutive passes (agreement) or after four total moves (time expires). The decision nodes have player labels and the terminal nodes are shaded.

Figure 1: Scenarios 1 game matrix, notation, and tree root with optimal decisions.

This module begins with the West making the second move, and extends the game tree shown in Figure 1. The game ends after two consecutive passes (agreement) or after four total moves (time expires). The decision nodes have player labels and the terminal nodes are shaded.

Figure 2: Scenario 1 continuation trees with optimal decisions.

In this game-tree analysis, bold-faced arrows indicate the best decision (choice of policy) for the agent at each decision node, given that play has reached that state and the game has not terminated. A connected path of bolded arrows (an equilibrium path) indicates optimal (interacting) decisions of the agents leading to the UO. Off an equilibrium path, there are still ‘best’ decisions, but they lead to worse outcomes, in particular for the player who moved off the equilibrium path, as the other player exploits her ‘mistake’. There are, however, multiple equilibrium paths, as there are several ways, in the course of four ‘moves,’¹⁶ to achieve the UO. Each of these longer paths involves a ‘testing’ of the opponent, offering her a chance to make a mistake, to become trapped in a less desirable (for her) state.¹⁷ Thus, whatever Russia does in response to Western sanctions, there is always an equilibrium continuation (Figure 1).

If Russia backs off (**LG** – in left branch), the West optimally passes (to Figure 4B), at which point Russia resumes destabilization (**DS**) or invades openly (**IN**), improving the situation in her preference ordering. Either way, the West,

¹⁶ A “pass” (maintaining the current state) is not counted as a “move.”

¹⁷ Stepping outside this formal model, these paths might also represent an agent “exploring” the poorly understood preferences of her opponent. Formal analysis of this possibility requires using an incomplete information framework, which we do not pursue here.

This module begins with the West making the second move, and extends the game tree shown in Figure 1. The game ends after two consecutive passes (agreement) or after four total moves (time expires). The decision nodes have player labels and the terminal nodes are shaded.

Figure 3: Scenario 1 continuation trees with optimal decisions.

Figure 4 extends the game three shown in Figure 1. Figure 4A begins with the West making the third move. Figure 4B begins with the West passing after two prior moves were made. Figure 4C begins with the West passing after two prior moves were made. The game ends after two consecutive passes (agreement) or after four total moves (time expires). The decision nodes have player labels and the terminal nodes are shaded.

Figure 4: Scenario 1 continuation trees with optimal decisions.

realizing that any move will be terminal and put it in an ultimately worse state, rationally passes. Russia then either passes, if in **SN-DS**, or moves to **SN-DS** (higher in her preference ordering than **SN-IN**) ending the game.¹⁸ If Russia openly invades (right branch, top of Figure 1), the West's optimal decision is to 'pass', to maintain sanctions, realizing (given the preferences of this scenario) that Russia would rather destabilize Ukraine than engage in an on-going costly and unnecessary invasion. Finally, the simplest equilibrium path arises when Russia, looking ahead at all possible moves and countermoves, realizes that it can do no better (unless the West makes a serious mistake, plays irrationally) than **SN-DS**, and so 'passes', maintaining its destabilization policy. Similarly the West also comes to the same realization and 'passes', maintaining its sanctions. The West might be tempted to draw back (**BU**) in the hope that Russia would do the same, but the optimal Russian continuation (Figure 2) forces (**BU-SN**) to become the terminal state, a far worse outcome for the West. Finally, if the West chooses to step up its opposition to Russian destabilization through the addition of military assistance (**MA**) to sanctions (another equilibrium path; see Figure 3), Russia will optimally 'pass' leading the West to rationally pull back to just sanctions, giving the UO, **SN-DS**. Thus the ToM game tells fully coherent stories of how the equilibrium UO could be achieved, and each story can be checked against the historical record as it unfolds.

In this framework, we can also ask what keeps both Russia and the West from achieving their most preferred states. Why does the West achieve its second most preferred state, even in scenarios in which it responds rather weakly to Russian aggression, and why does Russia only achieve its third best state, even when **IN** is a dominant strategy? The answers lie in the threats and counterthreats inherent in the interacting structure of preferences laid out in the game tree.

The West most prefers s_1 (**BU-LG**) [see the payoff matrix in Figure 1]. What blocks its attainment? The West has opportunities to end the game at s_1 at two points in Figure 1, but Russia has a credible threat in both cases (once to move to s_2 and once to move to s_9). That induces the West to 'pass' after the second move by Russia. Also, in Figure 3, the West has a chance to make the final move to s_1 , but Russia averts that possibility by passing on her previous turn to move. Figure 4C offers one last possibility for the West to make the final move to s_1 , but here Russia averts the possibility by making a move to s_5 on the previous turn to move.

Russia would prefer s_2 or s_3 to the UO. What blocks Russia from achieving those outcomes? In Figure 1, Russia could move to its best (or second-best) state on the final move, but the West thwarts that possibility by passing on the previous

¹⁸ With a longer horizon, there can be more moves dancing around the UO, **SN-DS**, but rational players will always use the last two moves as here.

turn to move (leading ultimately to s_5 , the UO). Russia also has two opportunities to end the game in its best (or second-best) state in Figure 2, and there is a highlighted path leading to s_2 , but this path is broken by the West at the top of Figure 2 (also shown in Figure 1); the West's other options both lead ultimately to s_5 . In Figure 3, Russia might also sit at s_2 after three moves, but would then opt to move to its second-best state because the West has a credible threat to move to s_5 in its final turn to move. Even so, Russia fails to achieve its second-best state, because of the West's choice one move earlier (which again leads to s_5). Russia has one more opportunity to reach s_2 on the final move in Figure 4A, but the decision by the West to pass on the previous turn (leading ultimately to s_5 ; also see Figure 1), thwarts the Russians once more.

Each one of the other scenarios yielding the UO, **SN-DS**, could have a similar decision tree, showing the sequential recursive optimization from terminal states that generates, and supports, that UO. While the paths followed, and the stories told, would be different, reflecting the differences in the driving preference orderings, the qualitative characteristics and reasoning supporting the UO would remain the same. Hence we do not elaborate those trees.

3.2.2 Scenario 8 analysis

Another, increasingly plausible, preference structure for Russia is captured in Scenario 8, where Russia ranks **IN** generally higher as more necessary to achieve its strategic objectives. In Figures 5–8 we present the possible paths from the initial state for the Scenario 8 preference configurations and highlight the equilibrium paths which yield **SN-IN** as the UO; a similar game tree could be derived for Game 6 which yields the same UO. We maintain the historically given initial state (**BU-DS**) and first mover (West). Again the 4-move game tree clearly displays the logic of, and along, the two equilibrium paths Russia might follow, at its first move, that lead to the UO. As in the Scenario 1 game tree, it also shows alternative strategic interactions that generate the same UO, and the threats and counterthreats that support all those equilibrium paths; more would appear with a longer horizon, but the UO remains the same, **SN-IN**, with the West achieving (given these preferences) its third-best state as does Russia, (7,7).

With her Scenario 8 preferences, Russia must take an action: escalate to Invasion, or Let Go; she cannot “pass” allowing the West then to “pass,” thereby fixing the final outcome at **SN-DS**, when she would prefer to invade in the face of aggravating Western sanctions. And the West would indeed “pass” if Russia did, since analysis of the game tree (Figure 5) shows that any move from **SN-DS** by the West ultimately leads (with optimal play in the continuation game by both Russia

This module begins with the West making the second move, and extends the game tree shown in Figure 5. The game ends after two consecutive passes (agreement) or after four total moves (time expires). The decision nodes have player labels and the terminal nodes are shaded.

Figure 7: Scenario 8 continuation trees with optimal decisions.

Figure 8 extends the game tree shown in Figure 5. Figure 8A begins with the West making the third move. Figure 8B begins with the West passing after two prior moves were made. Figure 8C also begins with the West passing after two prior moves were made. The game ends after two consecutive passes (agreement) or after four total moves (time expires). The decision nodes have player labels and the terminal nodes are shaded.

Figure 8: Scenario 8 continuation trees with optimal decisions.

previous turn to move, or “passing” (maintaining s_6), thereby terminating the game.

A similar situation arises with respect to s_5 . That state could result were Russia to pass on her first opportunity to move, but Russia, foreseeing that outcome (which is only 4th best for her), moves by (temporarily) Letting Go (see the equilibrium paths in Figures 5 and 8B), or by Invading (see the equilibrium paths in Figures 5 and 8C). Any attempt to subsequently set up a move to s_5 by “passing” (Figure 8B, C) leads Russia to invade, or destabilize followed by invasion on the last move. Thus the best the West can do is achieve the UO, **SN-IN** (s_6).

Russia would prefer s_3 (**BU-IN**) or s_2 (**BU-DS**) to the UO, s_6 (**SN-IN**). What blocks Russia from achieving those outcomes? In Figure 5, Russia could move to its best (or second-best) state on the final move, but the West thwarts that possibility by passing (maintaining **SN**) on the previous turn. This sets up two equilibrium paths leading ultimately to the UO, s_6 (Figure 8B). Russia also has two opportunities to end the game in its best (or second-best) state in Figure 6, and there is a highlighted path leading to one of these terminal nodes, but this path is broken by the West at the top of Figure 6 (also shown in Figure 5); the West's dominant option (maintaining sanctions) never becomes a possible choice, as Russia systematically moves away from s_5 , denying the West that option. In Figure 7, Russia can reach s_2 after three moves, but only if the West returns to Business as Usual in the face of Russian Destabilization, allowing Russia to achieve its best, and the West's third worst, state **BU-IN** (s_3). The West thus optimally chooses **SN**, allowing a Russian Invasion to achieve the UO s_6 (**SN-IN**). Moreover Russia's remaining at s_2 is deterred by the West's credible threat to move to s_5 .

Thus each party has credible threats, or optimal preemptive moves, that block the attainment by the other of its favored outcomes. The UO reflects their balance, as can be seen by tracing out the recursive rationality of its generation. That process also guarantees that the UO is Pareto undominated, a situation which cannot be improved for either player without hurting the other.

4 Conclusion

In this paper we have provided a framework for analysis of the strategic interaction in an on-going international crisis. The analysis presumes consequentialist rationality by the actors, and the ability to look ahead through some finite sequence of moves and countermoves (Brams 1994), although the agents need not be especially foresighted. In the cases we have analyzed in some detail, convergence to the UO occurs in 3 or fewer moves, although allowing the agents four

moves of foresight leads to several longer equilibrium (i.e., without “mistakes” being made by any agent) paths to the UO.¹⁹ Thus we can use a finite termination time (horizon) defined in terms of the number of policy changes and policy responses the agents can keep track of, can manage, in their strategic analysis of the situation. This allows recursive rationality, “dynamic programming” recursion, to determine the optimal strategies, given the assumed preferences of each of the agents and hence the equilibrium path and termination state (“Ultimate Outcome” – UO) of the strategic interaction.

Our analysis shows that there are only three potential equilibria (UOs) in this strategic interaction, despite the broad range of potential preference configurations studied. For most preference configurations, **SN-DS** is the UO – Russia destabilizes the Ukraine, creating a “frozen conflict” (Socor 2014) that blocks the consolidation of a democratic, Western-oriented polity, while the West settles into a stable configuration of ongoing sanctions, punishing Russia, at high cost to itself, for “bad behavior.” Another possible UO is **BU-DS**, where the West believes that preserving a democratic, Western-oriented Ukraine is not worth the cost, again allowing Russia to achieve its geopolitical objectives through successful destabilization. These West preferences (Scenarios 6, 7, 11, and 12) shy away from any kind of military assistance to Ukraine (too “provocative”) and from the costs of sustained sanctions in the face of ongoing destabilization of Ukraine by Russia. Hence the West returns, ultimately, to Business as Usual, despite ongoing Russian destabilization of Ukraine. A final, and apparently increasingly plausible, configuration of preferences, reflects a Russian unwillingness to allow Ukraine to overcome the destabilization by defeating Russia’s proxies in eastern Ukraine militarily. Such preferences are given in Scenarios 8 and 13, and lead to the UO **SN-IN**, where the West maintains sanctions, but Russia openly invades to insure the failure of Ukrainian military actions and the division of the Ukraine through the creation and support of an “autonomous” (of Ukraine only!) *Novorossiia*. The open (if still denied by Russia) invasion of Ukraine at the end of August 2014 may reflect the achievement of this UO, if the West maintains its resolve for sanctions, or may reflect a strategic “move” on the path to **SN-DS** (or even **BU-DS**) as we see in the game-tree analysis of some scenarios above.²⁰

¹⁹ Other possible preference configurations can require four to six “moves” before converging from some initial states, although the historically given state, **BU-DS**, from which we begin never requires more than three.

²⁰ This possibility emerges quite clearly along several equilibrium paths to the UO **BU-DS** in the game tree for Scenario 7 (not shown).

In our formulation, Ukraine is a “pawn” in the game, part of the environment in which the interests of the two main parties play out. Within the limits of the framework of this model, Ukrainian preferences are clear. The three best states are those in which Russia “Lets Go,” **BU-LG** $\succ$ **MA-LG** $\succ$ **SN-LG**, and the next two states are those with Western Military Assistance, **MA-DS** $\succ$ **MA-IN**. The four worst states involve an inadequate Western reaction to Russian aggression: **SN-DS** $\succ$ **SN-IN** $\succ$ **BU-DS** $\succ$ **BU-IN**. Thus all the UO we have derived are undesirable from the Ukrainian perspective: the most likely, **SN-DS** is fourth worst, **SN-IN** is third worst, and **BU-DS** is second worst. This highlights the divergence between the interests of Ukraine from those of the main protagonists, and thus the irrelevance of Ukrainian preferences for the strategic decisions being made about Ukraine’s future by both Russia and the West. However, our analysis shows that the key to attaining the best (for Ukraine) of the three potential UOs, **SN-DS**, lies in persuading the West to prefer **MA-IN** to **SN-IN**, i.e., to be willing to provide serious military assistance.

As the events of July and August, 2014, have shown, Ukrainian actions can change the perceptions of the players, their understanding of the consequences of different policies, and hence their rankings of those consequences. Ukraine’s slow but steady military success in those months cast doubt on the viability, the sustainability, of “freezing” the conflict in eastern Ukraine, without an overt Russian invasion in support of their proxies and agents in *Donbas*. This threatened the Russian geopolitical objective of leaving Ukraine divided and under strong Russian influence; “Destabilization” as described above was becoming inadequate for that purpose. Thus we may have seen a shift in Russian preferences from those reflected in Scenarios 1, 2, and 4 to those in Scenario 3 or Scenario 8. Indeed, by the beginning of September 2014, it became clear that Russia was pursuing the Invasion (**IN**) policy discussed above, rescuing her agents and covert armed elements in eastern Ukraine from what appeared to be an impending military defeat. This invasion has quickly reversed Ukrainian successes, strengthening the military and bargaining position of Russia’s proxies in Eastern Ukraine, thereby all but ensuring that a “frozen conflict” is the best Ukraine can hope for. While this situation might be the UO (Scenario 8), it might also be a stage in the interaction, a step along an equilibrium path either leading back to **SN-IN** (as in Scenario 8) or to **SN-DS** (Scenario 3) or even to **BU-DS** (Scenario 7). By February 2015, with another cease-fire solidifying Russian/insurgent gains, the next move remains up to the West. It will reveal more of the fine structure of West preferences by indicating the equilibrium path being followed.

Appendix

5.1 Description of policy-induced outcomes/states

- **BU-LG** With the West pursuing “business as usual” and Russia stepping back from direct interference in Ukrainian affairs (“letting go”), the likely outcome is the consolidation of the new, weak, pro-European government attempting to steer Ukraine toward the European Union, following the path blazed by most east European nations 10–15 years ago. Political divisions in Ukraine would be addressed through some form of decentralization of the unitary state through constitutional reform, new parliamentary (*Verkhovna Rada*) elections, and greater local control over local finances. And substantial economic reforms would be pursued, under IMF and EU guidance, to prepare for eventual accession into the EU. Thus Russia would face diminishing influence in Ukraine, the loss of a geopolitical buffer and of a manipulable, friendly border state with an economy substantially dependent on, indeed symbiotic with, the Russian economy.²¹ Ukraine is also considered by Russia a critical member of the Eurasian Customs Union and free trade zone, an organization that is seen as an important part of rebuilding Russian international influence. Relative to the pre-crisis situation, this outcome is negative in both dimensions, economic and geopolitical, with the latter being far more serious, there being worse economic conditions that might be generated in other possible outcomes. For the West, on the other hand, this is perhaps the best possible outcome: Ukraine westernizes its institutions and politics and moves toward Europe, international norms (modulus the Crimean annexation) are upheld, bloodshed is minimized, and there is no need to suffer the large economic costs associated with economic sanctions and/or military actions. But Crimea is lost to Russia without any lasting resistance from the West. **(9, 3 or 4)**
- **BU-DS** Here the West pursues “business as usual,” with the EU states in particular profiting from continuing business relationships with Russia, while Russia pursues active destabilization of the Ukrainian polity and economy, and the Crimean annexation falls from the agenda. Thus Russia gives active assistance, including military equipment and (covert) personnel (“volunteers” many with GRU military backgrounds), to armed groups seizing gov-

²¹ Before the crisis, over 83% of Russian weapons systems depended on critical Ukrainian inputs/components. See “*Naskol’ko ekonomika Ukrainy zavisit ot ES i ot Rossii* (How much does the Ukraine Economy Depend on the EU and on Russia?)” *Vedomosti*, 4 April 2014.

ernmental structures in Eastern Ukraine and seeking autonomy (*Novorossiya*) and eventual incorporation into the Russian Federation (as happened to Crimea). This sustains crisis conditions in Ukraine, preventing consolidation of the central state and democratic institutions, and undercutting recovery from the ongoing recession/depression in the economy. Embargoes of critical Ukrainian products, limitations on energy supplies, and demands for a price substantially above European for natural gas supplies, all constitute aspects of the destabilization policy, as does a continuing, high intensity propaganda campaign stirring fear in eastern Ukraine (controlled by the rebels) and hate in Russia for the new Ukrainian government. Propaganda and disinformation, both internal and external, provide a shield against Western influences and information. In this situation, Ukraine struggles to consolidate a functional national government, while waging a prolonged war, without significant Western assistance, on its own territory against Russian proxies. Economic and institutional reform toward European norms remains extremely difficult and slow, if not absolutely impossible. If, despite active Russian support for the insurrection, Ukraine achieves a military victory, it will be at the cost of vast devastation in its east, with little prospect of support from the “business as usual” West. More likely is a “frozen conflict” as in Moldova (Trans-Dnestria), Azerbaijan (Karabakh), and Georgia (Ossetia and Abkhazia), with Russia controlling the situation with “police forces” as the leading “peacekeeper” under OSCE auspices. This situation is *perhaps* the best of all for Russia, as it maintains the benefits of integration in the world economy while blocking the movement of Ukraine toward Europe. For the West, while economically lucrative, this situation poses challenges to its core values and understanding of how the world should work – conceptions of human rights, respect for national boundaries, and the diplomatic resolution of disputes are all egregiously violated. (5, 8 or 9)

- **BU-IN** In this state, the West’s “business as usual” strategy is maintained in the face of an open Russian cross-border military incursion into Ukraine. Responding to calls for help from its armed agents in eastern Ukraine (Donetsk, Luhansk, and surrounding seized territory), and claiming a “humanitarian crisis,” Russia sends its military forces with full air cover across the border, destroying the Ukrainian air force and driving the Ukrainian army out of at least those two provinces, liberating the “Russian people” who live there. This sets the stage for the creation of an independent state, *Novorossiya*, which will petition for admission into the Russian Federation, just as Crimea and Sevastopol successfully did in March 2014. At a minimum, it creates a “frozen conflict” state on the Ukrainian border, splitting off a piece of Ukraine that can only survive under Russian protection. The politi-

cal and economic consequences for independent Ukraine are even more dire than under **BU-DS**, with major portions of industry (in particular coal, metallurgy, and machine building) lost, and Russian economic warfare undercutting the viability of much of the rest of the economy. With the Western **BU** strategy indicating an abandonment of independent Ukraine, Ukraine is apt to reverse its recent (post-Maidan) orientation and return to the Russian orbit in the hope of regaining its industrial east, if not Crimea. For Russia, this is a near ideal scenario, achieving all Putin's strategic goals, albeit at a high cost in terms of military operations, support for the (partially?) destroyed eastern Ukraine, and international reputation, influence, and ability to use international institutions in the future. For the West, this is one of the worst possible outcomes, although arguably better than being involved in active combat with Russia. While economic costs to the West are low, geopolitical costs are extremely high. Fundamental principles of the post-WW2 international order are violated, Western promises shown worthless, and international institutions of dispute resolution and peacekeeping meaningless. **(3, 8 or 9)**

- **SN-LG** This is a state in which the West is imposing costly (to itself as well as Russia) sanctions, while Russia has “let go” of independent Ukraine, if not Crimea, allowing the consolidation of the new, weak, pro-European government attempting to steer Ukraine toward the European Union. The sanctions, were this to be the final outcome, would be a continuing response to the annexation of Crimea by Russia. This policy pair may seem more plausible as an interim state, rather than as the final outcome.²² This is a desirable outcome for Ukraine, having all the advantages of **BU-LG** plus the albeit small hope of getting back Crimea. As Ukraine “Europeanizes,” reforming both politically and economically, Russia will lose influence in Ukraine, will lose a geopolitical buffer, and will lose a manipulable border state with an economy substantially interdependent with the Russian economy. This is one of the worst outcomes possible for Russia, compounding the direct economic and geopolitical costs of “losing” Ukraine with the costly sanctions imposed by the West. Those costs, in any “sanctions” state, will be compounded by Russia's “counter-sanctions” implemented to maintain face. For the West, this outcome is thus also less than desirable. Although its geopolitical objectives are met, it suffers from the not insubstantial costs of imposing sanctions on Russia and bearing Russian counter-sanctions. **(2, 1 or 2)**

²² For purposes of the ToM model, however, we will consider any state that lasts 3–5 years without significant change in strategy by the players, as the “Ultimate Outcome” of the strategic interaction.

- **SN-DS** In this state, the West is responding with consistent, serious economic sanctions to the systematic military, political, and economic destabilization of Ukraine by Russia and its proxies in Ukraine. These sanctions naturally cause costly counter-sanctions by Russia, magnifying the negative economic impact on both parties. Russian actions, and the negative consequences for Ukraine in this state are outlined (under **BU-DS**) above. While Russia suffers aggravated economic costs, it achieves its primary geopolitical objective of preventing a successful, Western oriented, democratically united and led Ukraine on its border, as well as keeping the militarily significant strategic province of Crimea. Thus, despite the economic and international reputational costs, this situation ranks high in the Russian preference ordering. For the West, this is a state in which it consistently pursues its geopolitical imperatives while limiting its sacrifice (economic costs it must bear) in doing so. Thus it ranks high in the West preference ordering. **(7 or 8, 6 or 7)**
- **SN-IN** In this state Russia has launched, and maintains an active military intervention in eastern Ukraine – “peacekeeping” to prevent a Ukrainian military victory over the Russian led, equipped, and financed separatist insurrection in Donetsk and Luhansk provinces – as well as economic warfare against the Ukrainian state. The West’s response is further hand-ringing and lamentation and some strengthening of economic sanctions, answered in kind by Russia. The dire consequences for Ukraine are the same as in **BU-IN**, while the West bears even greater geopolitical costs (its efforts had no impact on the collapse of the international order) as well as substantial economic costs, while Russia again achieves its geopolitical aims if at a substantially higher economic cost than in **BU-IN**. **(6–8, 6 or 7)**
- **MA-LG** The situation in which the West provides substantial military assistance to Ukraine, while continuing to sanction Russia, after Russia has “let go” of further attempts to control Ukraine’s destiny, is even more costly for the West than **SN-LG**, as it is financing a Ukrainian buildup, and perhaps somewhat more costly for Russia as it moves to counter that military buildup in a no longer friendly border country. Geopolitically, the West does marginally better in maintaining commitment to the sanctity of international borders (no seizure of territory by force), while Russia suffers all the geopolitical costs, outlined above, of “letting go” of Ukraine. And these costs are cemented in place by the Ukrainian hostility generated by the loss of tourism- and energy-rich Crimea. Thus this outcome is truly among the worst for Russia. **(1, 1–3)**
- **MA-DS** This is the situation in which the West provides substantial military assistance to Ukraine, while continuing to sanction Russia, as Russia continues to actively destabilize Ukraine (as described above: **BU-DS**). The consequences for Ukraine remain as described there, although it has greater

chances of achieving a military victory over the Russian-backed insurrection than it would without military assistance. Thus the costs to Russia are raised in both dimensions, while the West gains geopolitically (seriousness of intentions, commitment to the established international order, credibility of commitments, etc.), if at a substantial increase in economic costs, including those from Russian counter-sanctions. The direct cost of such assistance to both sides is apt to be rising as Russia increases its provision of military support to the insurrection, even if refraining from direct military intervention across the border. **(4, 2 or 5)**

- **MA-IN** This is a “brink of war” state of the conflict. Russia has launched a cross border invasion of Ukraine, albeit with limited objectives as described above, while the West has added direct military support, short of combat forces (“boots on the ground”), to Ukraine while continuing to impose significant economic sanctions on Russia. Ukraine will suffer as described above, but will be able to put up much stiffer resistance to the Russian invasion, imposing substantially higher costs on Russia. The West will bear the same costs and benefits as in **MA-DS**, while substantially raising the costs to Russia which will now include military losses. While Russia can win militarily, separating out an independent *Novorossiya*, or annexing it like Crimea, that would be incredibly costly and have potentially extremely serious other consequences, beyond what we consider here. Thus Russia seeks to achieve, albeit at higher cost, what it could achieve from destabilization without West’s military assistance to Ukraine. This state rises dramatically in the West preference ordering as Russia’s invasion justifies military assistance and the costs it imposes. **(7, 4 or 5)**

5.2 Key Events in the Ukraine 2014 crisis.

Date	Event	Comment
22–23 Feb	President Yanukovich flees Ukraine, through Crimea	massive disturbances begin in south-east Ukraine, Crimea
26–27 Feb	Crimean government institutions seized	Russian covert military intervention (“green men”)
18 Mar	Russia Annexes Crimea	insurgency in Donbas; covert Russian (military) support
17–20 Mar	First US, EU and Canada Sanctions	followed by further sanctions
April	Donetsk, Luhansk governments seized	28 April by militias led by Russians with Russian “technical” support

(Table 5.2 Key Events in the Ukraine 2014 crisis continued)

Date	Event	Comment
5 May	DPR, LPR hold Referendum, declare independence	unrecognized internationally, “respected” by Russia
25 May	Ukraine Presidential election	Poroshenko absolute majority (57.4%); far right gets <2%
mid-June	Greatest extent of insurgent held territory	with substantial Russian military aid, “specialists”/advisers
17–25 July; Aug	US and EU extend sanctions; Switzerland, Japan others join	sanctions further extended through fall, winter 2014
July–Aug	Ukrainian push to reclaim Donbas from rebels & Rus “volunteers”	reduces territory held by insurgents/Russians by two-thirds
17 July	Malaysia Airlines flight 17 destroyed by insurgent missile	advanced Russian military equipment
15 Aug	Donetsk, Luhansk cut off; maximum Ukrainian advance	only 105 km of Russian border under rebel control
20 Aug	Massive Russian military intervention begins	heavy equipment; regular forces, claiming to be “volunteers”
22–25 Aug	‘Russian aid’ (proclaimed “humanitarian”) convoy	providing food, medications, armaments and munitions
24 Aug–4 Sept	Russian forces rout Ukrainian in southeast, invade along coast	Russian troops in rebel advance along Black Sea to Mariupol
5 Sept	Minsk Protocol (cease-fire) signed; major Russian units leave	all forces regroup, reinforce; insurgents continue attacks
26 Oct	Parliamentary (<i>Verkhovna Duma</i>) elections	4 moderate parties receive over 65% of votes; far right <7%
Sept–Dec	Continued fighting, expansion of rebel territory; Russian support	no withdrawal of heavy equipment, as agreed in Minsk
Jan 2015	Insurgents renounce cease-fire, begin military offensive	increasing Russian reinforcement, including manpower
11–12 Feb 2015	EU brokers new Minsk-2 Cease-Fire, to begin 15 February 2015	insurgents, Ukraine fight to push back cease-fire line
13–19 Feb 2015	Insurgents seize key strategic city of Debaltseve from Ukraine	with Russian military support, in violation of cease-fire

5.3 Scenario matrices

The 8 scenarios that we discuss above are laid out in Appendix Figure 1, which displays for each game the first move from the initial state (↓), the Ultimate

Policy Options for West: BU (Business as Usual), SN (Sanctions), or MA (Military Assistance)
Policy Options for Russia: LG (Let Go), DS (Destabilize), IN (Invade Ukraine)
Arrows indicate initial states and first movers in ToM; stars indicate Ultimate Outcomes
Payoffs underlined in Nash Equilibria

Appendix Figure 1: Summary of the most plausible scenario matrices.

Policy Options for West: BU (Business as Usual), SN (Sanctions), or MA (Military Assistance)
Policy Options for Russia: LG (Let Go), DS (Destabilize), IN (Invade Ukraine)
Arrows indicate initial states and first movers in ToM; stars indicate Ultimate Outcomes
Payoffs underlined in Nash Equilibria

Appendix Figure 2: Comparing Scenario 1 with interesting alternative scenarios.

Outcome (★), and the pure-strategy Nash equilibria (underlined, if any). Appendix Figure 2 compares Scenario 1 with several other interesting, and possible, Scenarios (preference configurations) that are not fully developed in the text. These illustrate the robustness of the ToM equilibria (UO) that we find and their significant differences from standard Nash equilibria.

These games capture, in our view, all of the plausible and some interesting, if less plausible, configurations of Western and Russian preferences over final outcomes in this crisis. They illustrate a remarkable robustness of the Ultimate Outcome to variations in Russia preferences, and its dependence on the willingness of the West to confront Russian aggression with direct military assistance to Ukraine.

5.4 Computing UO in ToM

The ultimate outcomes in the 2-player, sequential-move strategic game of revised ToM are calculated using a Gauss Language program, “Willson_ToM.prg,” adapted from a Pascal program written by Steven J. Willson, and shared with us. The program implements the Willson (1998) formulation of ToM through an optimizing backward recursion in the number of “moves” remaining in the extensive-form game tree (e.g., Figures 1–4 and 5–8). At each stage (i.e., number of “moves” remaining) it compares the the ultimate payoffs for the moving player from each branch to which she might move; those payoffs are known recursively from the prior stage (with one less move), calculated in turn from the results of its prior stage (with two fewer moves), etc., going back to the zero-moves-remaining state, which gives the players the payoffs of the current state. This recursion is implemented by hand in Figures 1–4 and 5–8.

The program tracks the state-matrix index (i, j) of the optimal move at each stage and the payoffs (n, m) associated with that optimal (at that stage) state. Thus the program determines the best policy for the player whose turn it is to move, and the ultimate payoff to that policy choice (branch of the game tree), given subsequent optimal play by both players on their sequential turns at each (with fewer moves remaining) stage. The program terminates after some fixed (pre-assigned) number of moves. Convergence to the UO is seen when, after some finite number of moves, the optimal decision leaves the state unchanged for every longer horizon. In all the ordinal games we have studied we have never encountered a preference structure (payoff matrix) that required more than six moves to converge to the UO.

The program and its computational modules, which will run in GAUSS 6 through GAUSS 16, are available on request from the authors.

References

- Aron, L., (2014), How to Make Putin Back Down, *CNNOpinion*, Available at: http://www.cnn.com/2014/08/29/opinion/aron-russia-putin-ukraine/index.html?hpt=hp_t1, August 29, 2014.
- Brams, S.J., (1994), *Theory of Moves*, Cambridge University Press, Cambridge.
- Brams, S.J., (1997), The Rationality of Surprise: Unstable Nash Equilibria and the Theory of Moves, in Geva, N., Mintz, A., (eds.), *Decisionmaking on War and Peace: The Cognitive-Rational Debate*, Chapter 6, Lynne Rienner Publishers, Boulder, CO, pp. 103–129.
- Coplin, W.D., (1965), International Law and Assumptions About the State System, *World Politics*, vol. 18, no. 4, pp. 615–634. Reprinted in: Williams, P., Goldstein, D., and Shafritz, J. (eds.) (1999), *Classic Readings in International Relations*, 2nd Ed. Harcourt Brace, Fort Worth, TX, pp. 270–287.
- Gilboa, I., (1995), Review of Theory of Moves, Games and Economic Behavior, vol. 10, no. 2, pp. 368–372.
- Hedlund, Stefan, (2005), *Russian Path Dependence*, Routledge, London.
- Keenan, E.L., (1986), Muscovite Political Folkways, *The Russian Review*, vol. 45, no. 2, pp. 115–181.
- Kilgour, D.M., (1984), Equilibria for Far-Sighted Players, *Theory and Decision*, vol. 16, no. 1, pp. 135–157.
- Kilgour, D.M., Zagare, F.C., (1987), Holding Power in Sequential Games, *International Interactions*, vol. 13, no. 2, pp. 91–114.
- McDermott, R., (2014), Russian Military Rehearses Ukrainian Peacekeeping Operation, *Eurasia Daily Monitor*, vol. 11, no. 148, pp. 1–2.
- Pipes, R., (1974), *Russia under the Old Regime*, Charles Scribner's Sons, New York.
- Simon, M.V., (1996), When Sanctions can Work: Economic Sanctions and the Theory of Moves, *International Interactions*, vol. 21, no. 3, pp. 203–228.
- Socor, V., (2014), Transnistria-Type Scenario Looming in Ukraine's Donbas (Parts 1 and 2), *Eurasia Daily Monitor*, vol. 11, no. 146, 147, pp. 1–2 in each.
- Willson, S.J., (1998), Long-term Behavior in the Theory of Moves, *Theory and Decision*, vol. 45, no. 3, pp. 201–240.
- Zeager, L.A., Ericson, R.E., Williams, J.H.P., (2013), *Refugee Negotiations from a Game-Theoretic Perspective*, Republic of Letters, Dordrecht, NL.